EP0786820A3

Publication Title:

Organic thin film transistor with enhanced carrier mobility

Abstract:

An organic thin film transistor including a gate (21, 31, 41, 51, 61, 71) on a layer of gate insulator material (22, 32, 42, 52, 62, 72), a source (25, 35, 45, 55, 65, 75) and a drain (26, 36, 46, 56, 66, 76) positioned in spaced apart relationship on a film (24, 34, 44, 54, 64, 74) of organic semiconductor material with uniaxially aligned molecules, the film (24, 34, 44, 54, 64, 74) of organic semiconductor material being positioned so that the molecules are aligned between the source (25, 35, 45, 55, 65, 75) and drain (26, 36, 46, 56, 66, 76) in a direction from the source (25, 35, 45, 55, 65, 75) to the drain (26, 36, 46, 56, 66, 76), and an orientation film (23, 32, 43, 52, 63, 73) positioned adjacent the film (24, 34, 44, 54, 64, 74) of organic semiconductor material so that molecular uniaxial alignment of the film (24, 34, 44, 54, 64, 74) of organic semiconductor material is achieved by the orientation film (23, 32, 43, 52, 63, 73).

---

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 786 820 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
01.07.1998 Bulletin 1998/27

(43) Date of publication A2:
30.07.1997 Bulletin 1997/31

(21) Application number: **97101017.8**

(22) Date of filing: **23.01.1997**

(51) Int. Cl.[6]: **H01L 51/20**, H01L 51/30

(84) Designated Contracting States:
DE FR GB

(30) Priority: **29.01.1996 US 592930**

(71) Applicant: **MOTOROLA, INC.**
Schaumburg, IL 60196 (US)

(72) Inventors:
- **Shi, Song Q.**
  Phoenix, Arizona 85044 (US)
- **Shieh, Chan-Long**
  Paradise Valley, Arizona 85253 (US)
- **Lee, Hsing-Chung**
  Calabasas, California 91302 (US)

(74) Representative:
Gibson, Sarah Jane et al
Motorola
European Intellectual Property Operations
Midpoint
Alencon Link
Basingstoke, Hampshire RG21 7PL (GB)

(54) Organic thin film transistor with enhanced carrier mobility

(57) An organic thin film transistor including a gate (21, 31, 41, 51, 61, 71) on a layer of gate insulator material (22, 32, 42, 52, 62, 72), a source (25, 35, 45, 55, 65, 75) and a drain (26, 36, 46, 56, 66, 76) positioned in spaced apart relationship on a film (24, 34, 44, 54, 64, 74) of organic semiconductor material with uniaxially aligned molecules, the film (24, 34, 44, 54, 64, 74) of organic semiconductor material being positioned so that the molecules are aligned between the source (25, 35, 45, 55, 65, 75) and drain (26, 36, 46, 56, 66, 76) in a direction from the source (25, 35, 45, 55, 65, 75) to the drain (26, 36, 46, 56, 66, 76), and an orientation film (23, 32, 43, 52, 63, 73) positioned adjacent the film (24, 34, 44, 54, 64, 74) of organic semiconductor material so that molecular uniaxial alignment of the film (24, 34, 44, 54, 64, 74) of organic semiconductor material is achieved by the orientation film (23, 32, 43, 52, 63, 73).

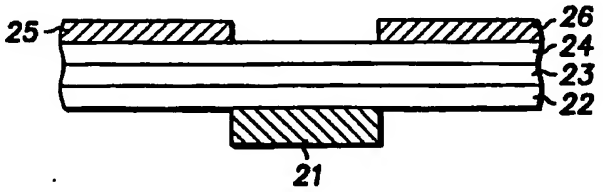

FIG. 2

20

EP 0 786 820 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 10 1017

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	PATENT ABSTRACTS OF JAPAN vol. 095, no. 011, 26 December 1995 & JP 07 221367 A (MATSUSHITA ELECTRIC IND CO LTD), 18 August 1995, Y * abstract *	1,6-10 2,4	H01L51/20 H01L51/30
Y	GARNIER F ET AL: "AN ALL-ORGANIC "SOFT" THIN FILM TRANSISTOR WITH VERY HIGH CARRIER MOBILITY" ADVANCED MATERIALS, vol. 2, no. 12, 1 January 1990, pages 592-594, XP000576217 * the whole document *	2,4	
X	JP 07 206 599 A (MATSUSHITA ELECTRIC IND CO LTD) 8 August 1995 * the whole document *	1,2,6-10	
P,X	& US 5 546 889 A (WAKITA KATSUYA ET AL) 20 August 1996 * column 2, line 36 - column 3, line 43; figure 8 *	1,2,6-10	
P,X	& US 5 556 706 A (WAKITA KATSUYA ET AL) 17 September 1996 * column 1, line 13 - column 3, line 31 *	1,2,6-10	TECHNICAL FIELDS SEARCHED (Int.Cl.6) H01L
A	US 5 079 595 A (SUZUKI SHOJI ET AL) * abstract; figures 2,3 *	4	
A	GARNIER F ET AL: "Molecular order in organic-based field-effect transistors" 2ND JAPAN-FRANCE JOINT FORUM (JFJJF'2) ON ORGANIC MATERIALS AND OPTOELECTRONIC DEVICES, PARIS, FRANCE, 23-24 NOV. 1995, vol. 81, no. 2-3, ISSN 0379-6779, SYNTHETIC METALS, 15 AUG. 1996, ELSEVIER, SWITZERLAND, pages 163-171, XP002055360		

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 April 1998	Königstein, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 10 1017

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	HOLLAND E R ET AL: "Effects of order and disorder on field-effect mobilities measured in conjugated polymer thin-film transistors" JOURNAL OF APPLIED PHYSICS, 15 JUNE 1994, USA, vol. 75, no. 12, ISSN 0021-8979, pages 7954-7957, XP002055361		
A	KOEZUKA H ET AL: "Macromolecular electronic device" JAPAN-FRANCE JOINT FORUM '93. ORGANIC MATERIALS FOR ELECTRONICS AND PHOTONICS, SAITAMA, JAPAN, 17-18 NOV. 1993, vol. 255, ISSN 1058-725X, MOLECULAR CRYSTALS AND LIQUID CRYSTALS, 1994, SWITZERLAND, pages 221-230, XP002055362		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 April 1998	Königstein, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)